**REMARKS**

This amendment supplements the one previously submitted with respect to the above-identified U.S. patent application, on September 7, 2001. By the foregoing amendment, Applicant has further revised the language of Claims 1 and 11, and provides the following comments in order to facilitate and advance the prosecution of this application.

With regard to Claim 1, the Office Action states at paragraph 3 that the electric power line (200) in Nagashima (U.S. Patent No. 5,994,790) corresponds to the "electric power line" of the present invention, and that Nagashima also includes a plurality of short sensors (58a-58x) that correspond to "a plurality of short sensors" of the present invention. Applicant respectfully submits, however, that the structure and function of these elements in Claim 1 differ from the cited elements in Nagashima.

One object of the invention defined in amended independent Claim 1 of the present invention is to curtail the effect of a short circuit failure in a particular segment of the electric power line (the master electric power line or the main electric power line) which connects the respective modules of the whole power supply system. For this purpose, a

short of the electric power line (the master electric power line) for connecting electrically between the respective modules is detected or estimated (forecasted), and the power supply shutdown means (for example, relays 111, 112), which are provided in the predetermined power supply control modules (RIM, FIM, PCM, BCM) are cut off according to CPU 170, 270, 370 being as "a control circuit". In the process, a part of the master electric power line having a short circuit is separated. Thus, the "plurality of short sensors" defined in the amended independent Claim 1 of the present invention can monitor the occurrence of short circuit failures of the master electric power line for connecting one module and another module.

Further, in the invention defined in amended independent Claim 1, the power supply shutdown means (for example, relays 111, 112) are arranged at the upstream side of the semiconductor switching element for controlling the supply of the electric power to the load. The power supply shutdown means (for example, relays 111, 112 in Figure 5) are arranged in a position where the master electric power line that connects the respective modules with one another is able to open, and also are arranged separately from the semiconductor switching element.

On the other hand, Nagashima monitors the abnormal current which flows into the electric power line (200) downstream (relative to the current flow) of the semiconductor switching element (54A-54X) for controlling the electric power supply to the loads (53A-53X).

In Nagashima, when the semiconductor switching element assumes an "off" condition, a plurality of short sensors cannot carry out its function.

Further in Nagashima, the continuity control signal of the semiconductor switching element for controlling the electric power supply to the loads is removed according to the protection circuits (55A-55X) and the semiconductor switching element for controlling the electric power supply to the load is cut off. Accordingly, the circuits including the loads in the downstream side of the semiconductor switching element are separated.

With the construction shown in Nagashima, as stated above, when a short circuit occurs on the upstream side (for example, the master electric power line between the one module and another module) of the semiconductor switching element for controlling the electric power supply to the loads, the protection function of the present invention as described

above cannot be performed. That is, when a short occurs, since the abnormal current does not flow downstream of the semiconductor switching element for controlling the electric power supply to the loads, the circuit cannot detect the abnormality itself.

Further, in Nagashima, when a short occurs upstream of the semiconductor switching element for controlling the electric power supply to the loads, the battery discharges electricity through the short circuited point. Accordingly, the semiconductor switching element for controlling the electric power supply to the loads is cut off, and however it works, it cannot remove the short circuit failure which has occurred in the upstream side. As a result, the whole system is down.

The techniques for protecting the system from the short abnormality shown in the invention defined in the amended independent Claim 1 of the present invention thus differs fundamentally from that of Nagashima.

The Office Action states that "the use of the fuses is well known in the art". However, Applicant respectfully submits that the use of fuses as recited in the combination of

Claim 3 is not merely an obvious modification to provide fuses in a known circuit.

In the invention defined in Claim 3, the electric power line for the load drive and the electric power line for the control circuit drive are connected to the battery through the respective separate fuses. As a result, even if a short circuit occurs in the electric power line for the load drive use, it does not influence the electric power line for the control circuit drive use.

On the other hand, Nagashima, from a single (only) electric power line VB which is connected to the battery, through the regulator (61), the control circuit drive power supply is supplied to the micro-computer (60) being the control circuit. Further, from the single (only) electric power line VB, through the semiconductor switch portion (54A-54X), the load drive power supply is supplied to the loads (53A-53X).

With the above described construction shown in the Nagashima reference, when a short occurs in the electric power line VB formed between the semiconductor switch portion (54A-54X) and the battery, both the load drive circuit and the control circuit suffer the influence of the results.

Accordingly, when power is not supplied to the control circuit, for example, it is possible that the short is not communicated to other modules, and the signal for activating a protection operation cannot be output.

The technique of the invention defined in Claim 3 of the present invention thus differs from that of Nagashima .

In Nagashima, the use of a fuse is not considered. Certainly, as shown in Yoshida, the provision of a "fuse" between a battery and a load is well known in an electric power supply circuit for an automobile. However, in Yoshida, Applicant has found no teaching in which the load drive electric power line and the control circuit drive power supply are connected to the battery through respective separate fuses such that, when a short occurs in the load drive electric power line, its effect does not reach the control circuit drive electric power line. That is, in Yoshida, the control circuit drive electric power line branches from the load drive electric power line. (See the electric power line 6, the electric power circuit 1430, the load drive use electric power line 1431, the micro-computer 1432, shown in Fig. 12 of Yoshida). The above construction shown in Yoshida is the same as that of Nagashima.

Similarly to Claim 3, as stated above, in Claims 7-9 of the present application, the electric power line for the load drive and the electric power line for the control circuit drive are connected to the battery through the respective separate fuses.

As a result, even when a short circuit occurs in the electric power line for the load drive, it does not affect the electric power line for the control circuit drive. The technique shown in the invention defined in Claims 7-9 of the present invention differs significantly from that of the Nagashima and Yoshida references.

In particular, in Claim 7, when a short occurs in the first power supply system of the load drive system, from the control circuit of the second power supply system, the control signal output and the protection circuit of the first power supply system is driven. Accordingly, the reliability of the protection system can be heightened further.

In other words, not only does the control circuit in the second power supply system control the load drive circuit of the first power supply system, but it also controls the protection circuit of the first power supply system. Accordingly, even when a short circuit failure occurs in the

first power supply system, the signal for controlling the protection circuit of the first power supply system can be driven.

In each of the Nagashima and Yoshida references, however, as stated above, from the load drive electric power line from which the control circuit drive use electric power line is branched, when a short occurs in the load drive use electric power line, the control circuit itself drives the protection circuit. Accordingly, it cannot output a control signal to drive the protection circuit.

In particular with regard to Claim 8, the ignition apparatus of the engine control system and the power supply system of the injector are connected to the battery through the control system fuse which is separated from the power supply system of the equipment system (the installation system). Accordingly, a short circuit of the power supply system for the peripheral equipment does not affect the ignition apparatus of the engine control system or the power supply for the injector. Thus, with the above stated constructions, even when the peripheral equipment system is down due to a short circuit, it does not affect the operation of the engine.

With regard to Claim 9, a shutdown circuit is provided as a protection circuit, between the "fuse" and the driver" circuit. Accordingly, a short which cannot be protected against merely by cut-off of the drive circuit does not cause the fuse to be fused; and when multiple control loads are operated, the protection operation can be carried out partially.

Both Nagashima and Yoshida are silent with regard to the provision of a shutdown circuit as a protective measure between the "fuse" and the driver circuit". In Nagashima, the semiconductor switch 54 serves both as the load drive element and the protection element. however, Applicant has found no teaching regarding a short circuit of the electric power line VB to the semiconductor switch portion 54. On the other hand, in Yoshida, FET 1436 etc.) serves both as a load drive element and as a protective element, similarly to that of the reference of Nagashima.

According to the invention defined in Claim 9, even when the load drive semiconductor switching element breaks down, it is possible to carry out the circuit protection operation.

With regard to Claim 10, the Office Action states that the sizing of the cables dependent on the load supplying

requirements is well known in the design of a power distribution system. In regard to this observation, Applicant notes that, like Claim 3, in the invention defined in Claim 10, the electric power line for the load drive and the electric power line for the control circuit drive are connected to the battery through the respective "fuses" (the separate "fuses"). Thus, even if a short occurs in the electric power line for the load drive, it does not affect the electric power line for the control circuit drive.

In addition, in order to limit the increase in the wiring harness as much as possible by separating of the load drive use electric power line and the electric power line of the control circuit system, the control signal line is thinner than the load drive electric power line.

Further, in the invention defined in Claim 10 of the present invention, the plural load control modules are connected to the same load drive power supply system. (For example, in the embodiment shown in Fig. 4a, the load drive control modules 5, 10, 11, 14, 16, 29 are connected to the load drive system electric power lines 12A-12H which are connected to the battery through the "fuses" 43, 4f.)

The respective control circuits 170, 270, 370 provided on the plural load drive control modules are connected to the battery through the respective independent "fuses" 4a-4d, 4g, 4h. Accordingly, the control circuits are each separated independently from a short circuit failure of the control system electric power wiring harness.

As a result, in the invention defined in Claim 10, the system has high reliability, not only with respect to a short circuit of the load drive electric power line but also with respect to a short circuit of the electric power line of the control circuit system can be obtained.

Claim 11 relates to the load control module. One important feature of the load control module is that it has a communication circuit, as well as a relay which closes and opens the electric power line for supplying the electric power to the driver circuit. Thus, in accordance with the information received from another module through the communication circuit, the relay which protects the one load is controlled, and the part of the electric power line in which the short abnormality has occurred can be separated.

As stated above, the invention defined in Claim 11 of the present invention, the restrictions concerning the location of

the function for carrying out circuit protection and the location for providing the protection circuit are minimized, thereby enhancing the freedom in design of the circuit.

Further, the information used to judge the operating of the protection circuit is taken into the consideration not only for the information of the one module itself but also for another module. Thus, according to the invention defined in Claim 11, the judgment for operating the protection circuit can be performed surely and in various ways, achieving diversity of operation.

Finally, while both Nagashima and Yoshida disclose the use of a semiconductor switching element as the driver, neither discloses the module's distinctive construction according to the invention. In particular, neither Nagashima nor Yoshida discloses the module having the relay connected and arranged intermediate the load drive electric power line in addition to the semiconductor switching element as the driver.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in

general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

It is respectfully requested that, if necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #381NP/47981).

Respectfully submitted,

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS**

1. (Three times Amended) A power supply apparatus for a vehicle, comprising:

an electric power line comprising a plurality of sequentially connected segments wired in an interior of a vehicle from a battery, for supplying power to various kinds of loads of said vehicle via a plurality of modules which are connected to receive electric power via respective segments of said electric power line;

a semiconductor switching element connected between each respective segment and a load supplied by said segment for controlling electric power to said load;

a plurality of short sensors for detecting a short circuit in at least one of said plurality of segments of said electric power [lines;] line, said at least one segment connecting respective modules;

a power supply shutdown means connected in series with each segment of said electric power line connecting respective modules, said power supply shutdown means being connected in series with said semiconductor switching element to supply electric power to said semiconductor switching means;

a control circuit for specifying a short circuited segment of said electric power line in accordance with a short detection condition of said plurality of short sensors; and

means responsive to signals from said control circuit for cutting off the power supply cutoff means, and removing the short circuited segment from said electric power line for supplying power to said loads.

11. (Twice Amended) A load control [system having a load control] module [which is installed at a specific position of a vehicle, for a] of an electric power supply apparatus [of the] for a vehicle, said load control module comprising:

a communication circuit which is connectable to at least one other [another] module of said power supply apparatus through a communication line;

a control circuit for outputting a load control signal in accordance with a signal which is inputted through said communication circuit;

[a battery;]

a drive circuit connected to an electric power line that is coupled between said modules, for controlling a power supply to [said] a load of said vehicle in accordance with an output signal from said control circuit; and

a relay for opening and closing a connection that branches from said power line to a particular load as a function of an output from said control circuit, [; and] said relay opening and closing in response to load control signals output from said control circuit.

[a first fuse connected between said battery and said specific load for fusing when an over-current flows into said particular load.]